

# **Demonstration of an Environmental Indicator System for the CALFED Solution Area**

**Rainer Hoenicke**

## **Public Comments**

No public comments were received for this proposal.

# Technical Synthesis Panel Review

## Proposal Title

#0210: Demonstration of an Environmental Indicator System for the CALFED Solution Area

Final Panel Rating
inadequate

## Technical Synthesis Panel (Primary) Review

### TSP Primary Reviewer's Evaluation Summary And Rating:

Calfed has an acute need for a science-based, statistically robust, communicable set of performance measures that incorporates socioeconomic considerations and links with management decisions. Hence the need for this research is great. The question is whether the proposed approach will move the program in that direction. The proposal is vague. General directions are proposed, but there is little specifics. The success of the effort depends upon specifics. It seems as though funding this proposal would be giving them a blank check. Many have tried to develop performance measures; it is not clear that this team will be any more successful than others have been. I am particularly concerned that they promise much more than can realistically be delivered. (It is unlikely that a peer-reviewed article on such a complex process will be published in two years.) Because the development of such a broad system of indicators is extremely complex, further development of specifics in some areas of the approach would assuage concerns about the feasibility of the work proposed. The success of the whole depends upon task 1, which is identification of proposed indicators. Without demonstrated success with that, the rest of the proposed work would be of little value.

#0210: Demonstration of an Environmental Indicator System for the CALFED Solu...

## Additional Comments:

External reviewers rated it as fair, very good and very good. All agreed that the goals of the proposal were excellent and definitely needed. Some concern was raised that the PIs did not recognize some of the good indicator work occurring in other countries (e.g. Australia). Reviewers were concerned about the general descriptions of available indicators but with little evidence that the group has given a lot of prior thought to indicators they would use. The team could make a major contribution (1) IF the data exist to perform the analyses they envision and (2) IF they are well integrated with those working at the field end of indicator development. Otherwise it is garbage in, garbage out. There was not enough evidence in this proposal to allay that concern. The goals expressed are "the Holy Grail" of indicator development. Reviewers were not convinced that the authors will find that "Holy Grail." Many others have tried. The conceptual model provides a hierarchical structure for creating indicators that address both the assessment of CALFED actions as well as the natural system's ecological integrity. This provides a useful broad framework, but the authors need to provide a more specific model of how the indicator system would be developed. The details will determine how truly feasible the proposal is. The proposal needed further development of the specifics. The authors do not seem to have a lot of experience with aquatic indicator development, and several CVs were missing. The inclusion of socioeconomic indicators was viewed as very positive BUT the expertise in economics appears to be lacking from the assembled team. The statistical methods suggested may be inadequate for complete vetting of the indicators and methods. Many of the suggested analyses assume independence of errors and measures. Semivariance is only a start in dissecting the complex relationships of drivers and indicators across many scales. Numerous latent processes exist that could confound results. Conducting the analyses within a Bayesian framework could better account for the issue of error propagation. Some concern was expressed about Scorecard development in that technical decisions will require a much more complex understanding of the drivers, mechanisms, and impacts to the Bay-Delta system. The budget was too high

## Technical Synthesis Panel Review

without a better indication that they will be successful, and even then some reviewers thought it excessive. One reviewer who rated it a "very good" noted "the relatively substantial potential for failure."

Calfed has an acute need for a science-based, statistically robust, communicable set of performance measures that incorporates socioeconomic considerations and links with management decisions. Hence the need for this research is great. The question is whether the proposed approach will move the program in that direction. The proposal is vague. General directions are proposed, but there is little specifics. The success of the effort depends upon specifics. It seems as though funding this proposal would be giving them a blank check. Many have tried to develop performance measures; it is not clear that this team will be any more successful than others have been. I am particularly concerned that they promise much more than can realistically be delivered. (It is unlikely that a peer-reviewed article on such a complex process will be published in two years.) Because the development of such a broad system of indicators is extremely complex, further development of specifics in some areas of the approach would assuage concerns about the feasibility of the work proposed. The success of the whole depends upon task 1, which is identification of proposed indicators. Without demonstrated success with that, the rest of the proposed work would be of little value.

## Technical Synthesis Panel (Discussion) Review

### TSP Observations, Findings And Recommendations:

Demonstration of an environmental indicator system for the CALFED solution area

The development of reliable performance measures is a major objective and a demonstrated need for the CALFED program. If successful, this study would provide valuable tools for CALFED and its associated resource managers. However, the reviewers and the panel all felt that the proposal did not adequately

## Technical Synthesis Panel Review

demonstrate that the investigators would be successful in this work. The entire program depends upon success of the first task, in which likely indicators would be proposed. Yet the proposal merely described a process without identifying candidate indicators or specifying criteria to be used in selecting from the larger list of possible indicators. Without more specifics on this task, assessing the likely success of the following work was difficult. The proposal also provided insufficient evidence that the required high-quality data for this project would be available. The panel also felt that there may be insufficient statistical and economic analysis experience on the team. Because there was no clear evidence that the project would be successful and the participants may not have demonstrated experience (hard to evaluate with missing CVs) for developing indicators for aquatic species, the proposal was ranked as inadequate.

Final Ranking: Inadequate.

# Technical Review #1

proposal title: Demonstration of an Environmental Indicator System for the CALFED  
Solution Area

## Review Form

### Goals

Are the goals, objectives and hypotheses clearly stated and internally consistent? Is the idea timely and important?

Comments	<p>The proposed goals are stated as being to: 1) develop and test a consistent methodology for standardizing and validating proposed indicators, 2) develop and test ecological indicators, 3) develop and test related social indicators, and 4) develop process for spatiotemporal aggregation of indicators, combined to result in 5) a robust regional indicators system for use in decision making. These goals are, for the most part, clearly stated, and they are logical steps in the creation of a broad suite of social/ecological indicators for measuring effectiveness of CALFED programs (i.e. they are internally consistent). I remain partially unclear whether the final, ultimate goal, is to create a single indicator system (as suggested in goal 5) versus a broader framework for developing a cohesive indicator system that may be modified for more locally-based needs. Both are important; however, the latter may be more realistic. Overall, these goals sum up the "Holy Grail" of assessment - the development of a simple yet robust indicator system. Indicators and metrics are currently a favorite topic; but beyond their current vogue, they will remain an important part of any program effectiveness/natural systems assessment program. The proposal speaks directly to this important need to develop a cohesive set of indicators that can be used across the entire CALFED solution area.</p>
Rating	

## Technical Review #1

	very good
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### Justification

Is the study justified relative to existing knowledge? Is a conceptual model clearly stated in the proposal and does it explain the underlying basis for the proposed work? Is the selection of research, pilot or demonstration project, or a full-scale implementation project justified?

Comments	<p>There is ample justification for the proposed work. While the rationale might be better supported by further reference to current literature, the development of an indicator system would forward assessment and monitoring of both CALFED restoration activities as well as of the Bay Delta system as a whole. There has been significant previous work in this area, and in this lies the crux of the justification. The proposed work is very ambitious and numerous others have failed, in both the context of CALFED programs as well countless other programs. The work is strongly justified if the proposed research produces results beyond what has been accomplished by previous efforts. If not, the work will become part of an already large body of indicator suggestions that fail to provide tractable assessment methods. The proposal borrows a conceptual model from previous CALFED and its associated partners' work. The conceptual model provides a hierarchical structure for creating indicators that address both the assessment of CALFED actions as well as of the natural system's ecological integrity. This model provides a useful broad framework, but the proposal could do more to provide a more specific model of how the indicator system would be developed. The authors state that they will develop a system that meets both the needs of tracking performance of individual restoration projects and those who need to communicate success of cumulative investments at the landscape scale or the sum of incremental steps towards broad restoration goals: if the researchers succeed, the work is extremely justified.</p>
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## Technical Review #1

Rating	excellent
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### Approach

Is the approach well designed and appropriate for meeting the objectives of the project? Is the approach feasible? Are results likely to add to the base of knowledge? Is the project likely to generate novel information, methodology, or approaches? Will the information ultimately be useful to decision makers?

Comments	<p>The approach is well outlined in most task areas. It is apparent that thought has gone into the design of the overall research framework. The approach is feasible, although the final outcome may be more difficult than anticipated. If successful, the research would lead to a tractable and very beneficial tool in CALFED program assessment, as well as providing new scientific understanding of the ecological links between drivers of system restoration and resulting ecological integrity.</p> <p>The proposal's approach thoroughly addresses most of the steps that would be required to create a final indicator system. The proposal nicely identifies significant issues in indicator development and responds well to those issues. The approach also appears to thoughtfully consider the steps required to incorporate existing and previous work on indicator development. The proposed approach to dealing with multi-scale indices and indicators is well considered, and development of indicators from a foundation of conceptual models is essential to the success of the project. The hierarchy of indicators model portends a very successful system for linking both the drivers and resulting indicators at multiple scales where data/knowledge on the direct mechanisms of linkage may be lacking. The final steps include numerous approaches for sensitivity testing and validation of selected indicators and methodologies; this is an important and excellent portion of the approach.</p>
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## Technical Review #1

In several areas within the proposal, the justification and broad outline of the goals are repeated; streamlining of these portions of the proposal would serve both to make the proposal clearer as well as providing additional space to address more technical issues. Because the development of such a broad, multi-scalar, integrating system of indicators is extremely complex, further development of specifics in some areas of the approach would assuage my concerns about the feasibility of the work proposed. One small detail is that the proposal states that the EPIC method of developing indicators will be used; step C of the EPIC approach calls for selection of indicators based on selection criteria. It would be helpful if the proposal clearly stated what these criteria would be. Criteria for indicator selection are peppered throughout the proposal; an explicit summary of these would be helpful.

The primary weakness in the approach is that the statistical methods suggested may be inadequate for complete vetting of the indicators and methods. It is unclear under which statistical framework the analysis will be conducted. Many of the suggested analyses, while non-parametric, assume independence of errors and measures. The data is largely spatial in nature and many underlying assumptions are likely to be violated. Success of any regressions or correlations will rely on consideration of autocorrelative effects (the proposal does mention the ability to test for autocorrelation during trend analysis, but this concern is not raised elsewhere). Additionally, the proposal would benefit from further discussion of the type of regression and additional specifics on analysis of differing geographic scales. Semivariance is only a start in dissecting the complex relationships of drivers and indicators across many scales. Numerous latent processes exist that could confound results. A hierarchical modeling framework may be a better solution. Additionally, conducting the analysis within a Bayesian framework could better

## Technical Review #1

	account for the issue of error propagation and explicit modeling of error from non-replication of measurements in a more parsimonious manner than within a frequentist framework. While the proposed power and effect size analysis may achieve this goal, a non-frequentist framework, letting the data drive the prior distribution, may result in a better model. Lastly, in modeling the inter-relationships between indicators, I am unclear whether this is between only the social and ecological indicators or modeling relationships amongst the various ecological indicators as well.
Rating	very good

## Feasibility

Is the approach fully documented and technically feasible? What is the likelihood of success?  
Is the scale of the project consistent with the objectives and within the grasp of authors?

Comments	Except for the more detailed statistical specifics, the approach is well documented. The devil of this proposal lies in the details, however, as the broad concept of indicator development has been attempted several times. It is therefore the details that will determine how truly feasible the proposal is. The proposal would greatly benefit from further development of the specifics, as well as from additional time and consideration of a more detailed conceptual/visual framework of the approach.
Rating	very good

## Monitoring

If applicable, is monitoring appropriately designed (pre–post comparisons; treatment–control comparisons)? Are there plans to interpret monitoring data or otherwise develop information?

Comments	The entire process is envisioned within an iterative framework of assessing and reassessing indicators.
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## Technical Review #1

	There is substantial time and effort dedicated to task 5, which includes testing the system of indicators. Task 5.3 states that the researchers will identify system flaws and suggest methods for modifying the indicators in response to identified flaws. This is an extremely critical step in the creation of a workable, useable system of indicators; the proposal could go farther in stressing the importance of this step and clarifying the amount of attention to given to iterative updating of the indicator system.
Rating	very good

## Products

Are products of value likely from the project? Are contributions to larger data management systems relevant and considered? Are interpretive (or interpretable) outcomes likely from the project?

Comments	The products of the research are clearly delineated and would result in critical summary documentation of a comprehensive indicator system with accompanying validation tests, in addition to tangible means of disseminating the results. The culmination of all the products at each task level would provide and excellent summary methodology for assessing CALFED program effectiveness. The combination of scientifically detailed indicators, that reflect both states and mechanisms of change, and aggregated indices for easy communication of system integrity to the public would be extremely on target and directly applicable and immediately available to system managers and decision makers. Results would be pre-packaged so that indicators would be immediately interpretable for several Bay Delta regions, while development of a coordinated indicator system would be relatively straight-forward for other locations. Additionally, the format of products as papers for submission to peer-reviewed journals would provide new scientific and methodological insights.
Rating	

#0210: Demonstration of an Environmental Indicator System for the CALFED Solu...

## Technical Review #1

excellent
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### Additional Comments

Comments	Fewer acronyms would make review easier given that this reviewer is not directly involved in CALFED work. Figure 1 is vague and needs more explanation. A detailed schematic of the overall approach would have been very helpful. The words test and vet are repetitive. The proposal was somewhat repetitive, particularly in regards to the statement that while other work has been done, it has not been tested. If research moves forward, be careful to balance the desire to simplify the indicator framework with the need to represent the vast complexity of the system. While the scorecard model is useful for general insight into the system and for communicating with the public, technical decisions will require a much more complex understanding of the drivers, mechanisms, and impacts to the Bay Delta system. The OWQI methodology for scaling an index is confusing. Wouldn't temperature be site-specific based on a given location's range of variation/reference temperature? How could such a basic scaling model reflect that? The final part of task 4.3 appears to be the same as task 4.4.
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### Capabilities

What is the track record of authors in terms of past performance? Is the project team qualified to efficiently and effectively implement the proposed project? Do they have available the infrastructure and other aspects of support necessary to accomplish the project?

Comments	The project team has a strong background in water resource management and assessment.
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## Technical Review #1

	Numerous biologists and ecologists strengthen the team, complemented by engineers and a social scientist. The team is extremely well versed in issues related to the CALFED solution area, particularly those from SFEI and TBI. The difficulty of the task would require a flexible methodology and quantitative approach, which would be greatly benefited by a strong modeler, quantitative ecologist, or statistician on the primary team. While several of the lead scientists have modeling experience, it is unclear from their publications that they have the fluency with highly quantitative and statistical techniques that may be required for successful analysis. The team, representing several universities and NGO's, would have access to a very strong foundation of support and infrastructure.
Rating	very good

## Budget

Is the budget reasonable and adequate for the work proposed?

Comments	The budget consists primarily of wages for primary researchers and subcontractors. The rates proposed for both the researchers and subcontractors are extremely reasonable. Hourly rates for some subcontractors are fairly high, including Drs. Peter Vorster and Christina Swanson, but these are largely offset by relatively low rates for the other contractors/investigators. Travel and material costs are reasonable. The total project budget, spanning two years, is significant as a result of the numerous hours proposed for numerous contracts and investigators. The amount of work proposed is also significant, however, and the total budget appears both reasonable and adequate for the listed tasks.
Rating	

## Technical Review #1

	excellent
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### Overall

Provide a brief explanation of your summary rating.

Comments	There is significant merit to the research proposed, and successful implementation of the work would provide important new scientific knowledge in addition to extremely beneficial management tools. The approach is well documented but would greatly benefit from further detailing of specific methods, particularly in the area of statistical methods, given the complexity of the task and the relatively substantial potential for failure. This risk, however, is strongly offset by the essential nature of the research. The investigative team is strong and particularly well versed in Bay Delta issues and concerns; nonetheless, the team would be considerably strengthened by the addition of a quantitative modeler or statistician.
Rating	very good

# Technical Review #2

proposal title: Demonstration of an Environmental Indicator System for the CALFED  
Solution Area

## Review Form

### Goals

Are the goals, objectives and hypotheses clearly stated and internally consistent? Is the idea timely and important?

Comments	Yes. The goal is to develop a robust indicator system, which is an important objective to enable valid ecological monitoring and assess restoration success. This includes development of scientifically-sound environmental indicators, as well as approaches to the aggregation of indicators, and development of scorecards for presentation and decision-making. apparently they will also bring in social and economic criteria as well. This is timely and important.
Rating	excellent

### Justification

Is the study justified relative to existing knowledge? Is a conceptual model clearly stated in the proposal and does it explain the underlying basis for the proposed work? Is the selection of research, pilot or demonstration project, or a full-scale implementation project justified?

Comments	The PIs appear well versed in the issues, in prior work done thru Calfed, and in work on-going elsewhere. They have a good framework. A full-scale project to clarify indicators is needed to build on prior candidate lists and bring resiation to competing approaches.
Rating	very good



## Approach

Is the approach well designed and appropriate for meeting the objectives of the project? Is the approach feasible? Are results likely to add to the base of knowledge? Is the project likely to generate novel information, methodology, or approaches? Will the information ultimately be useful to decision makers?

Comments	<p>Others are enagged in this task elsewhere, so I hope they make every effort to learn in parallel with these other efforts. They seem well informed about other US efforts, but I suggest they look at the healthy waterways program and its scorecard approach at Griffith U, Brisabane. I was a bit disappointed in their description of the many indicators that exist, and how they will consult existing indicator frameworks and develop new indicators. This doesn't give me the sense that much prior work or thought has been expended. I can see some benefits in this team's testing of various indicators (apparently by assessing indicators developed or measured by others), but it is hard to see how they will develop new indicators or even decide which are the best of existing indicators based on this proposal. It feels like they will go fishing for what exists already, and then perform post-hoc analyses. But how are we to know what they will find on this fishing expedition? It is clear that no field work is involved, and the team's expertise seems to be mainly in stats and data management. I think that this team can make a major contribution if (a) the data exist to perform the analyses they envision, and (b) they are well integrated with folks at the field end of indicator development. Otherwise, the garbage in, garbage out rule could apply. I didn't find enough evidence in this proposal to allay this concern. See subtask 1.3, data scoping, for a clear indication that they</p>
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## Technical Review #2

	don't know what they will find. Data quality and appropriateness of reference condition for metric scaling are problems that even the most sophisticated statisticians will have limited success in resolving.
<b>Rating</b>	<b>fair</b>

## Feasibility

Is the approach fully documented and technically feasible? What is the likelihood of success?  
Is the scale of the project consistent with the objectives and within the grasp of authors?

<b>Comments</b>	Hard to assess likelihood of success because it depends on both the quantity and the quality of the existing data (and this team's ability to assess quality of what they get. This is pretty much the same concern as above - they haven't convinced me that something good will emerge from all this data massaging.
<b>Rating</b>	<b>fair</b>

## Monitoring

If applicable, is monitoring appropriately designed (pre-post comparisons; treatment-control comparisons)? Are there plans to interpret monitoring data or otherwise develop information?

<b>Comments</b>	This project concerns the design of indicators, rather than a field-based project that requires monitoring activities. This proposal promises to improve monitoring by improvements in monitoring tools
<b>Rating</b>	<b>very good</b>

## Products

Are products of value likely from the project? Are contributions to larger data management systems relevant and considered? Are interpretive (or interpretable) outcomes likely from the project?

#0210: Demonstration of an Environmental Indicator System for the CALFED Solu...

## Technical Review #2

Comments	depends on concerns above. a good indicator winnowing and scorecard development would be valuable
Rating	fair

## Additional Comments

Comments	might make sense to fund a much more modest feasibility study
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## Capabilities

What is the track record of authors in terms of past performance? Is the project team qualified to efficiently and effectively implement the proposed project? Do they have available the infrastructure and other aspects of support necessary to accomplish the project?

Comments	hard to say. they have solid quantitative analysis people, as well as a couple of biologists. But there does not appear to be much experience with environmental indicators, yet this is the core area they propose to "clean up". I would be much more reassured if they had documented experience at the nuts and bolts end of indicator development, and demonstrated capacity to interpret the data. There is a lot of good and bad data all mixed together, in my opinion.
Rating	fair

## Budget

Is the budget reasonable and adequate for the work proposed?

Comments	\$848k too much by far without better indication of success; even then, too much
Rating	

#0210: Demonstration of an Environmental Indicator System for the CALFED Solu...

## Technical Review #2

	poor
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### Overall

Provide a brief explanation of your summary rating.

Comments	good idea, but not convincingly developed.
Rating	fair

# Technical Review #3

proposal title: Demonstration of an Environmental Indicator System for the CALFED  
Solution Area

## Review Form

### Goals

Are the goals, objectives and hypotheses clearly stated and internally consistent? Is the idea timely and important?

<b>Comments</b>	The project's goals are clearly stated, progressively linked and internally consistent throughout the application. The concept is timely and critical for complicated regional restoration and protection projects.
<b>Rating</b>	excellent

### Justification

Is the study justified relative to existing knowledge? Is a conceptual model clearly stated in the proposal and does it explain the underlying basis for the proposed work? Is the selection of research, pilot or demonstration project, or a full-scale implementation project justified?

<b>Comments</b>	The project's conceptual model is clearly stated and very appropriate for a demonstration project to validate the methodology. Given the applications page limitation, more discussion or a critique of other emerging regional indicator programs would have been helpful to highlight their strengths/weaknesses and how the project can build on them to develop a suite of environmental indicators for the CALFED solution area?
<b>Rating</b>	very good

## Technical Review #3

### Approach

Is the approach well designed and appropriate for meeting the objectives of the project? Is the approach feasible? Are results likely to add to the base of knowledge? Is the project likely to generate novel information, methodology, or approaches? Will the information ultimately be useful to decision makers?

Comments	The project's approach to expand on, enhance and link past and current efforts in the CALFED solution area is critical to the project's success within the proposed timeframe and budget. In addition, the diverse team and their intimate experience in restoration, monitoring and management within the CALFED solution area strongly supports a project that is management driven/implementation focused. The proposed project's blend of basic and applied research with a good outreach effort to decision makers is a clear strength.
Rating	excellent

### Feasibility

Is the approach fully documented and technically feasible? What is the likelihood of success? Is the scale of the project consistent with the objectives and within the grasp of authors?

Comments	Again, I appreciate a clearly labeled heading that directly addresses the evaluation criteria. I strongly agree that the project team includes an appropriate and diverse collection of recognized experts with the possible exception of economics, which make this project feasible.
Rating	excellent

### Monitoring

If applicable, is monitoring appropriately designed (pre–post comparisons; treatment–control comparisons)? Are there plans to interpret monitoring data or otherwise develop information?

### Technical Review #3

<b>Comments</b>	Not applicable to this project.
<b>Rating</b>	not applicable

## Products

Are products of value likely from the project? Are contributions to larger data management systems relevant and considered? Are interpretive (or interpretable) outcomes likely from the project?

<b>Comments</b>	Generally the distribution of specific products for each task is appropriate and reflects the project's progression. The inclusion of a peer review process for final products is also commendable and helps ensure the quality of the products. However, I would caution against intermingling project reports for the sponsor and external peer reviewed journal articles. Given the project's proposed 2 year time period it is unlikely that any peer reviewed articles based on the project would be printed within the project period.
<b>Rating</b>	excellent

## Additional Comments

<b>Comments</b>	I greatly appreciated the letters of support and potential leveraging of resources included in the application. On task 2, is it really appropriate at this stage to examine sport fish mercury body burden targets? Is the source of the mercury known and within the grasp of management measures? This mercury issue carries on in subtask 2.4 it seems that the proposition "declines in sport fish mercury body burdens could be related to the recovery of commercial fisheries and thus related to positive employment impacts of restoration" is a giant causal leap. See the comment on capabilities for the suggestion that the team include or identify additional economic
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### Technical Review #3

	expertise. Would recommend project team use a consistent citation form (U.S. EPA vs. EPA) and double check references.
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## Capabilities

What is the track record of authors in terms of past performance? Is the project team qualified to efficiently and effectively implement the proposed project? Do they have available the infrastructure and other aspects of support necessary to accomplish the project?

Comments	The proposal is weakened by the lack of c.v.s from several key members of the project management team. The project's executive summary includes "social and economic" aspects of watersheds but other than political science and a multidisciplinary research approach the included c.v.s fail to document breadth in the social sciences and omit economics all together. This issue may be resolved without too much difficulty by slightly refining the project's scope. The included c.v.s showed a capable team but I was concerned by the lack of senior project members' c.v.s.
Rating	very good

## Budget

Is the budget reasonable and adequate for the work proposed?

Comments	The budget is appropriate for the number of senior researchers and their level of effort.
Rating	excellent

## Overall

Provide a brief explanation of your summary rating.

Comments	
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#0210: Demonstration of an Environmental Indicator System for the CALFED Solu...



Technical Review #3

	Despite some concerns about the lack of c.v.s from some senior project managers and the lack of documented economic expertise on the team; this is a very strong application. The project has well defined goals that reflect the teams' active participation in and strong relationships with many of the ongoing activities in the CALFED solution area. The need for the project is well documented and the approach very well thought out. I support funding this project.
Rating	very good

